NOAA FISHERIES SERVICE

Fish Age and Growth

Fish scales, otoliths (earbones), and other bony parts are used to determine the age of individual fish. This process is similar to finding the age of a tree by counting rings in the wood. Scientists in the northeastern United States have been using this method since the early 1900s.

Why Age Fish?

Knowing the age of a fish allows scientists to measure the amount of time involved for various processes affecting fish. For instance, data on fish size can be combined with age information to provide growth rates. The decrease in abundance from one year (age) to the next gives a measure of mortality rates due to the combination of fishing and natural causes. Age data is also used to determine how long it takes for fish to mature. Any of these values may change over time, so it is important to examine age samples regularly.

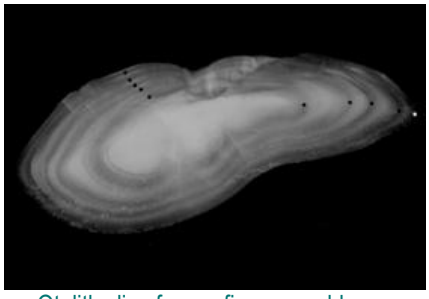
In addition, it is impractical to catch all the fish in a population. A better option is to obtain a small portion of the population and find the relative abundance at age for that portion. These age data, in conjunction with data from other sources, are then incorporated into population models to estimate the total number of fish in the wild. Such models allow scientists to monitor trends in the size of fish populations and to predict potential effects of fishing on those populations. The most detailed models include age-specific estimates of weight, mortality, and growth; this requires that a larger portion of the fish be aged.

How Are Fish Aged?

Fish grow faster in the summer than in winter, due to higher temperatures and increased food availability. Patterns in the scales and otoliths reflect this change: summer zones are wide, and winter zones are narrow. Fish can be aged by counting the number of paired summer/winter growth zones, called annuli. A fish with three annuli, therefore, would be three years old.

For different species of fish, different parts of a fish are used to determine ages. For some species, scales can be used; here, winter zones appear as regions where the ridges on the scale are closer together. If scales can't be used, otoliths (located inside the skull) may be used instead. In otoliths, the color of the zones differs, resulting in alternating opaque and translucent bands. Some otoliths are clear enough for these bands to be seen from the surface of the otolith; otherwise, the otolith can be thinly sliced in order to see the bands. Some species require that yet another structure be used (fin rays, vertebrae, etc.). In general, annuli from these structures are visible under a low-power microscope.

The choice of age structure for a species is determined based on which structure most accurately reflects the true age of the fish, has the clearest bands, and has the most cost-effective preparation method.



Otolith slice from a five-year-old haddock. Annuli (year-marks) are indicated. (Sample is about ¼ inch across.)

More information on the Fishery Biology Program can be found online at:

www.nefsc.noaa.gov/fbp

Website Features:
Guide to Fish Otoliths
Age Determination Manual
Fish Length to Age Calculator
QA/QC Results

Fishery Biology Program

The Fishery Biology Program is located in Woods Hole, MA, at the Northeast Fisheries Science Center (NEFSC) of the NOAA Fisheries Service. The program was established in 1965, initially to determine ages for haddock and yellowtail flounder from nearby waters. The original name for the program, "Age and Growth," is still used informally.

Each year, the group determines ages for about 55–90,000 samples from waters off the northeast coast of the United States. These samples represent 17 species of fish and shellfish. Over the years, we have gradually expanded our focus to include not only age and growth, but also reproduction and other aspects of fish and shellfish biology.

Our approach is to:

- Determine ages of individual fish and shellfish from collected samples
- Compile data on fish and shellfish growth, maturation, and reproduction
- Develop and improve age determination and processing methods
- Regularly monitor data quality of our results
- Collaborate with other agencies and laboratories to maintain consistency among age readers
- Support modeling of fish populations and management of healthy fisheries

We currently employ 12–15 biologists and technicians. Each species is assigned to a specific staff member. In general, it takes a new employee about six months to learn how to age a species; most employees begin by spending most of their time processing age samples and entering data. In 1988, the Fishery Biology Program published a manual of the methods we routinely use to age various species. These methods, as well as methods developed more recently, are available on our website (see link at left).

The program obtains age samples from fish living in the northwest Atlantic Ocean, between the Canadian border and Cape Hatteras, NC. There are three primary sources for these samples: scientific surveys, commercial landings, and discards. Scientific surveys are conducted on NOAA's research vessels four times each year, and samples from these ships are used to estimate the age composition of fish populations. Commercially-caught fish, landed at fishing ports along the coast, are sampled after they are unloaded from fishing vessels. The 'discards' are fish captured aboard fishing vessels but not brought to the market, and are sampled at sea by fisheries observers. These latter two sources are used to estimate the age composition of fish removed from the populations.

Our data are used in modeling the populations of these species, and the models are then used to advise management approaches for fisheries off the northeast coast of the United States. The Resource Evaluation and Assessment Division of the NEFSC publishes annual updates of the results of many fish population models (see www.nefsc.noaa.gov/sos), which incorporate age data from the Fishery Biology Program.